

Observations on the Biology of a New Species of *Dilyta* (Hymenoptera: Charipidae) from Washington State^{1,2}

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INTRODUCTION

The members of the superfamily Cynipoidea are thought to be predominantly phytophagous, but several families, including the Charipidae, are parasitoids. Most species of the family Charipidae belong in the subfamily Alloxystinae, and all are hyperparasites on aphids. The few species of the subfamily Charipinae have been reared from Psyllidae.

The genus *Dilyta* belongs in the subfamily Charipinae, a small assemblage of species divided among 2 genera (Fergusson 1986). *Dilyta* is represented in Europe by a single species, *D. subclavata* Foerster, reared from *Psylla pyri* (L.). *Dilyta* is recorded from North America in the Hymenoptera Catalog (Krombein et al. 1979), but A. S. Menke³ (in litt) has examined the types of *necans* Keiffer, the only species listed, and has concluded that "*Dilyta*" *necans* belongs in the Alloxystinae.

Ferris and Hyatt (1923) and Jensen (1957) reported on "*Alloxysta*" from psyllids in California, Eritrea (Ethiopia), and Italy. These were almost certainly misidentifications of a *Dilyta* species (Menke, in litt). We have reared a genuine species of *Dilyta* (det A. S. Menke) from a psyllid, however, thus confirming the presence of the genus in the New World. This insect is a new species, and it will be described by Evenhuis and Menke (in prep).

METHODS AND MATERIALS

Dilyta adults were reared from nymphs of *Psylla alba* Crawford (det D. R. Miller). Fig. 1 shows a female *Dilyta* sp. reared from *P. alba* in central Washington. A character common to the genera *Alloxysta* and *Dilyta* is the dorsal, triangular depressed area of the mesopleuron. The abdomen of the *Alloxysta* has 2 or more visible terga; the visible abdomen of *Dilyta* consists of 1 large tergum. Other characteristics of the genus *Dilyta* are: small size (<2 mm) and abdominal base (tergum 1) with a ring of dense setae.

Psyllid nymphs were collected from narrow leaf willow, *Salix exigua* L., 13 km north of Wenatchee, WA (elevation 180 m) during 1985 and 1986 (Table 1). This site is in a 15 m ravine along the Nahahum Canyon road adjacent to highway 97. Dominant vegetation included *S. exigua*, *Rosa* spp., and *Cornus stolonifera*

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Table 1. Collection and emergence dates for *Dilyta* n. sp. reared from *Psylla alba* in 1985 and 1986 in central Washington.

Collection Date	Emergence Date	Number	Sex ¹
19 AUG 85	NR ²	3	F
31 MAY 86	18 JUN 86	2,1	M,F
31 MAY 86	21 JUN 86	2	F
4 JUL 86	27 JUL 86	1	F
4 JUL 86	28 JUL 86	1	M
9 JUL 86	NR	1	M
9 JUL 86	27 JUL 86	1	M
9 JUL 86	31 JUL 86	1	F
8 AUG 86	12 AUG 86	1	M
8 AUG 86	NR	3,8,1	M,F,U
8 AUG 86	15 AUG 86	1	F
8 AUG 86	21 AUG 86	1	U
8 AUG 86	22 AUG 86	3	F
8 AUG 86	25 AUG 86	2	U
8 AUG 86	27 AUG 86	2	U
2 SEP 86	8 SEP 86	1	F

¹ F = female, M = male, U = undetermined.

² NR = not recorded.

Michaux. Collections of *S. exigua* with associated psyllid nymphs were made along the east-facing slope and bottom of the ravine.

S. exigua branches containing *P. alba* nymphs were clipped and placed in plastic bags. In the laboratory collected plant material was placed inside 250 ml glass beakers containing ca 25 ml water. Beakers were placed in cylindrical cardboard ice cream containers (3.8 liter). A plastic vial (2.5 cm diam) extended through the lid of the cardboard container into a 100 ml clear plastic specimen cup containing cotton moistened with sugar water. Emerging *Dilyta* entering the specimen cup were collected daily with an aspirator. This technique kept plant material fresh for 7–10 days. Laboratory observations of *Dilyta* adults were made of the insects inside 35 ml glass shell vials with cork stoppers held at room temperature (25°C) and 16:8 photoperiod.

Dilyta specimens were also collected in 2 unsprayed pear orchards by G. Paulson⁴ in May and July, 1986. Pear trees were sampled using a beating tray technique, and insects were collected from the beating tray with an aspirator. One orchard was located 6.6 km south of Cashmere, (Chelan Co.), WA in Yaxon Canyon (elevation 242 m), and the other was located 8.3 km southeast of Leavenworth, (Chelan Co.), WA in Derby Canyon (elevation 390 m).

To obtain electron micrographs adult *Dilyta* were killed after emergence by freezing, and then air-dried. Specimens were coated with gold (approximately 30 nm) using a Technics Hummer Sputter Coater and then examined with an ETEC Autoscan U-1 electron microscope.

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RESULTS AND DISCUSSION

Field Collections

On 19 August 1985, 3 female *Dilyta* adults were reared from *P. alba* nymphs. In 1986 a total of 33 specimens (18 females, 9 males, 6 of undetermined sex) were reared from *P. alba* from May through September (Table 1).

Salix growing at the Nahahum Canyon site maintained lush growth through August in 1986. The leafrollers, *Pandemis pyrusana* Kearfott, *Choristoneura rosaceana* Harris and *Filatima saliciphaga* (Keiffer) were common on the terminal shoots of *S. exigua*. *P. alba* nymphs were frequently found inside both abandoned and occupied leafroller feeding sites.

Host Searching/Oviposition

On 30 July, 2 newly emerged *Dilyta* adults (male and female) were placed into a shell vial containing 6 nymphs of *P. alba*. Within 5 min the *Dilyta* female, with ovipositor visible, positioned herself on the dorsal surface of a psyllid nymph.

On 30 August, 3 *Dilyta* adults (1 male and 2 females), approximately 3 hrs post-emergence, were placed into a shell vial containing early and late nymphal instars of *P. alba*. Within 5 min both *Dilyta* females were observed feeding on honeydew excreted by the psylla nymphs. Ten min after feeding, one female *Dilyta* positioned herself on the dorsal surface of a fourth instar. Both parasitoid and host were oriented in the same direction. Antennal contact between host and parasitoid was followed by probing behavior and penetration of the ovipositor into the psyllid abdomen. Oviposition lasted 2 min. In a 30 min period 4 psyllid nymphs were attacked by the female *Dilyta*. Psyllids moved back and forth apparently trying to dislodge the parasitoids as they attempted to oviposit.

Dilyta adults emerging 2 September (1 male and 1 female) were placed into a shell vial with various nymphal instars of *P. alba*. Behavior similar to that observed 30 August was noted. Feeding on honeydew was followed by searching, antennal contact with the host, and penetration with the ovipositor. Duration of a single oviposition attempt was approximately 2 min. The female died within 24 hrs following oviposition, but the male survived for 6 days.

Host searching and oviposition behavior observed in *Dilyta* sp. is similar to the described behavior of two aphid hyperparasite genera within the subfamily Alloxystinae, *Phaenoglyphis* and *Alloxysta*. *Phaenoglyphis americana* Baker has been studied extensively in California (Andrews 1978). *P. americana* palpates a host aphid with its antennae for several seconds, mounts the host, and palpates again while positioned on the dorsum of the aphid. If the aphid is accepted as a host, the parasitoid orients itself, head to head, and inserts its ovipositor into the abdomen of the aphid. The ovipositor may be inserted several times in the same host, with an insertion lasting as long as 5 min. A female *Alloxysta* will approach a live, parasitized aphid and rapidly palpate its surface. She then mounts the dorsum of the aphid, with her abdomen slightly bent, and inserts her ovipositor through the aphid cuticle, depositing the egg inside the still feeding primary parasitoid larva (Sullivan 1987).

Host Associations

All members of the subfamily Alloxystinae with known host associations are hyperparasites, attacking primary parasitoids belonging to the Aphidiinae



Figure 1. A new species of *Dilyta* (female) reared from *Psylla alba* in central Washington. x 66.

(Braconidae) and Aphelininae (Gordh 1981). Recent European authors disagree as to whether members of the Charipinae are primary or secondary parasitoids. Fergusson (1986) reported that *D. subclavata*, the single European species of the genus, is a primary parasitoid of psyllids. In southern France, however, *D. subclavata* is recorded as a hyperparasite of *Psylla pyri* through the encyrtid, *Prionomitus mitratus* (Dahlman) (Herhard 1986). *P. mitratus* is one of the key parasitoid enemies of *P. pyri* in Europe. It is Holarctic in distribution (Krombein et al. 1979) and has been recorded from several states in the USA on many species of psyllids (Jensen 1957). We have been unable to determine if our new *Dilyta* sp. is a primary psyllid parasitoid or a hyperparasite. Collection of *Dilyta* sp. from unsprayed pear orchards in central Washington indicates that this species may be an important component of the parasitoid complex of pear psylla, *Psylla pyricola* Foerster. Rearing records (Table 1) and collection of adults in the field during 1986 indicate the parasitoid was active from May through September.

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LITERATURE CITED

- Andrews, F. 1978. Taxonomy and host specificity of Nearctic Alloxystinae with a catalog of the world species (Hymenoptera: Cynipidae). Occas. Papers Entomol. State of California, Dept. of Food and Agriculture (Sacramento). No. 25, 128 pp.
- Ferris, G. F. and P. Hyatt. 1923. The life history of *Euphyllura arbuti* Schwarz (Hemiptera: Chermidae). Can. Entomol. 55:88-92.
- Fergusson, N. D. M. 1986. Charipidae, Ibalidae & Figitidae, Hymenoptera: Cynipoidea. Royal Entomol. Soc. London 8:7-15.
- Gordh, G. 1981. The phenomenon of insect hyperparasitism, and its taxonomic occurrence in the Insecta. Pp. 10-18. In Rosen, D. The Role of Hyperparasitism in Biological Control: a Symposium. University of Calif. Division of Agricultural Sciences. 52 pp.
- Herhard, F. 1986. Annotated list of the entomophagous complex associated with pear psylla, *Psylla pyri* (L.) (Hom.: Psyllidae) in France. Agronomie 6:1-34.
- Jensen, D. D. 1957. Parasites of the Psyllidae. Hilgardia 27:76-99.
- Krombein, K. V., P. D. Hurd, Jr., D. R. Smith, and B. D. Burks. 1979. Catalog of Hymenoptera in America North of Mexico, Vol. 1, Symphyta and Apocrita. Smithson. Inst. Press, Washington, D.C. 1198 pp.
- Sullivan, D. J. 1987. Insect hyperparasitism. Ann. Rev. Entomol. 32:49-70.